**Hamburg University of Applied Sciences**
**Faculty of Life Sciences**

**Master of Health Sciences degree**

# THESIS

## Health behaviour surveillance -

## Establishing a surveillance system monitoring Health Sciences students at Hamburg University of Applied Sciences

**Short running title:**

**Health behaviour surveillance of Health Sciences students**

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## Part I



## Part II

## LIST OF ABBREVIATIONS

| | |
|---|---|
| B | Baseline |
| CDC | Center of Disease and Control |
| CE | Pharmacological “cognitive enhancement” |
| FU | Follow-up |
| GiS | „Gesundheit im Studium“ (Health during studies] |
| HAW | University of Applied Sciences |
| HISBUS | HISBUS consists of two syllables: HIS stands for university information system and BUS stands for (higher) education policy |
| INSIST | Internet-based social norms intervention to prevent substance use of students |
| ISPI | Internet, students, peers and intervention |
| LUST | Lübeck University Student Trail |
| M | Mean |
| NRW | North-Rhine-Westphalia |
| PVP | Predictive value positive |
| SD | Standard deviation |
| 95% CI | 95 % Confidence Interval |

## ABSTRACT

Approximately 2.6 million adults were enrolled at German universities in 2014. Thereby they build a large group in society from which future policy makers or professionals will be drawn. Despite the number and importance of students, little is known about their health and health behaviours. Therefore, this thesis aims to establish a health behaviour surveillance system to provide urgently required answers; now and in the future.

In order to build a framework for this subject, this thesis starts with a theoretical and conceptual part. An introduction into surveillance through definitions, aims and concepts of surveillance systems in general is provided. In terms of the establishment of such a system, attributes as well as strengths and limitations are described (chapter 1).

Data about health behaviours of students at universities is limited. However, the research landscape of existing investigations focusing on students in Germany is discussed (chapter 2). Only few of the existing investigations fulfil the definition of a surveillance system, which strive to systematically and periodically collect data as a basis to analyse and in turn report information about the occurrence and trends of health and health behaviours of students. Thus, chapter 2 also provide methodological recommendations, which serve as a practical guideline for the establishment of surveillance systems to monitor students at universities.

Chapter 3 presents information about the health status of students in Germany to build a basis for illustrating the need of health behaviour surveillance of this target group. This includes classical health behaviours, such as nutrition, physical activity, smoking and alcohol. Above all, also shisha smoking and pharmacological “cognitive enhancement” among students are discussed.

The key question is then: Do we need surveillance systems monitoring students’ health? Chapter 4 will deal with the public health relevance and necessity of an extended data basis in order to decide whether to take action in health promotion for students.

As a result from this theoretical framework a second generation surveillance system to monitor Health Sciences students’ health and health behaviours at University of Applied Sciences Hamburg were established in 2014 (see chapter 5). Which methodological approaches are likely to be successful and also if students engage in health-promoting and health risk-behaviours are presented in form of a manuscript. In order to contribute to the knowledge in this research landscape, this manuscript will be submitted for publication in the International Journal of Public Health (chapter 7).

# PART I – THEORETICAL BACKGROUND

## 1. SURVEILLANCE SYSTEMS

### 1.1 Aims, definition and concepts

In order to prevent communicable as well as non-communicable diseases and to inform and manage public health programs, scientists need to monitor the occurrence of diseases over time (1–3). Therefore, basic epidemiological data, focussing on time, place and the individual person are needed to provide relevant information about the status of health problems in diverse populations of interest (1).

Consequently, one of the primary aims of surveillance systems is to monitor constantly the occurrence of diseases or health problems and their effects over time (1). Additional aims are the characterization of affected people and those at greatest risk and anticipation of future trends of health problems. Often surveillance systems bring out research questions for further epidemiological studies rather testing hypotheses (1). Besides, data from surveillance systems can provide crucial information for planning and evaluating public health programs (3).

These aims were portrayed in the definition of epidemiological surveillance by the US Center of Disease and Control (CDC) in 1986, relative to Langmuir (1963) (4):

> *„Epidemiological surveillance is the ongoing systematic collection, analysis and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link in the surveillance chain is the application of these data to prevention and control. A surveillance system includes functional capacity for data collection, analysis and dissemination linked to public health programs.“* (5)

The CDC's definition of surveillance is the most frequently used definition incorporating every aspect of epidemiological surveillance. However, the initial focus of surveillance systems was significantly extended beyond monitoring infectious diseases (1). Within the last years, surveillance systems also portray a wide range of public health concerns including chronic diseases, reproductive health, injuries, disabilities, environmental and occupational health hazards as well as health risk behaviours (6). Through the development of diseases during the last decades, the subject of surveillance systems is multifaceted. It ranges from initial tasks and functions (e.g. assessing dimensions and scope of health problems, detecting new or reoccurring epidemics) up to cutting-edge tasks (e.g. identify-

ing changes in behaviours, planning interventions to prevent and treat diseases) (2). In line with this expansion, surveillance systems grow from simple ad hoc arrangements into more elaborate structures. (1).

To investigate the variety of public health concerns, numerous approaches and methods to conduct surveillance were established depending on information needed and available resources (1). One of these upcoming approaches of modern surveillance is called Second Generation Surveillance. The aim of this approach is to explore existing diseases by concentrating on its associated factors; mainly exposures, risk factors, health-risk behaviour and co-morbidity (7). This approach is becoming increasingly important. Especially with regard to the establishment of a surveillance system monitoring students' health. Instead of focussing on existing diseases, the shift to monitor health-risk behaviour and predisposing exposures of diseases is needed due to the fact that most public health resources are invested to prevent exposures and health-risk behaviour (1). In line with this need, Second Generation Surveillance systems strive to provide sufficient information for the establishment as well as evaluation of specific prevention programs (7).

Corresponding to these concepts, periodic surveys, as a approach of surveillance systems, are useful to provide specific information of personally driven aspects and to monitor those over time (1). This includes behaviours associated with diseases and personal attributes that affect disease risks, health-related knowledge or self-reported disease occurrence (1). Relating to surveys as well as surveillance of health behaviour, definitions of health-related events under surveillance are often based on self-reports provided by participants. This has to be kept in mind while interpreting results, because self-reports come along with various potential forms of bias (e.g. information bias) (1).

## 1.2 Attributes of surveillance

There are several attributes or even requirements of surveillance systems, which all head for effectiveness of such systems. The mix of attributes should be balanced to meet needs relating to utility and costs, because not all attributes can be satisfied in full (1). The CDC elaborated these aspects in the course of establishing guidelines for evaluating public health surveillance systems (8). These attributes explain the characteristics and requirements of surveillance systems. In this case, description of these attributes should help to better understand the underlying concepts of this kind of research.

### Effectiveness

One of the key attributes of a surveillance system is its effectiveness. That implies that surveillance systems have to be streamlined regarding each step of scientific research. This applies in particular to data collection processes, analyses and dissemination of information (1). Besides, effectiveness also means appropriate communication of results to a variety of people; starting with health care providers up to policy makers (1).

### Simplicity

Due to the fact that surveillance systems need to be set up for the long-term maintenance of the surveillance system should be as simple as possible. Therefore simplicity of surveillance systems refers to various steps of scientific research. Nonetheless, processes should be efficient and straightforward whilst still providing answers to the underlying objectives (8).

### Flexibility

In case of new arising health problems and changing information needs, a public health surveillance system should be flexible as well as able to easily adapt to this changing needs with minimum additional resources (e.g. time, personnel and funds) (8).

### Data quality

Surveillance systems do not strive to collect all-embracing data concerning the health problem of interest, but rather concentrate on the essentials. Therefore the most important requirement of surveillance systems is to follow the principal of data economy, which means focusing on absolutely necessary data (9). However, data quality is improved if descriptive data, which is collected in surveillance systems, is as accurate and complete as possible as well as absolutely necessary to answer the underlying research questions. Its quality is also reflected by its completeness (8). Especially low percentages of missing values (“unknown” or “blank” responses) indicate high data quality (8).

### Acceptability

In order to provide accurate information over a long period of time, a surveillance system needs to be accepted by its participants and users. Consequently, acceptability of a surveillance system has strong implications on consistent, complete and timely data. Indicators of this attribute are willingness of persons and organizations to participate in a surveillance system as well as its timely dissemination of results (8). Moreover, the volume of application of results, the usefulness of results and to which extent participants are enthusiastic about the system (1,9).

### Sensitivity

In general, sensitivity of surveillance systems is reflected by the extent to which the system is able to identify all cases of interest (1). This could be explored by two different approaches: First, the proportion of cases detected by the system or second, by the ability to monitor changes over time (e.g. outbreaks of infectious diseases, increased prevalence of health-risk behaviour) (8). In case of an outbreak, sensitivity of public health surveillance systems has to be figured out to assess the truthfulness of this outbreak. This has to be done under consideration of (a) increased awareness of the health-related event, (b) introduction of new diagnostic tests (or data collection instruments) or (c) methodological changes of the underlying surveillance system (8). Even if sensitivity is low, such systems can also be helpful in monitoring trends in health problems as long as sensitivity is consistent over time and representativeness is satisfied (1,8).

### Predictive value positive

As for each diagnostic test, the predictive value positive (PVP) plays a role in surveillance systems. It is reflected by the ability to measure what it aims to measure (1). This comes along with the strong emphasis on the confirmation of cases reported through surveillance systems (8). Low PVP might have strong implications on conclusions and by that PVP is an important quality feature of the public health surveillance system. To make this clear a result of a surveillance system could be a “pseudo-outbreak” of non-confirmed cases that could lead to costly investigations and unjustified concerns in society, if PVP is low (8).

### Representativeness

Also representativeness of surveillance systems highly correlates with data quality. If both - representativeness and data quality – are satisfied, the system can accurately represent the health-event under surveillance (8). In case of representativeness, it is important that the system can accurately describe and reflect individuals of interest from the underlying target population (1). In line with low PVP, limited representativeness can lead to misdi-

rection of health resources (8). To elaborate the representativeness of health-events under surveillance, it could be helpful to compare basic characteristics of “cases” and “controls” of the underlying target population. Nevertheless, this is often quite difficult due to insufficient data about basic characteristics of both groups (e.g. age, sex, socioeconomic status, access to health care) (8).

### Timeliness

One of the most important attributes of surveillance systems is its timeliness. This is represented by the quickness of processing between all steps of the surveillance system; starting with collection of information up to dissemination of results (1). The timeliness of such a system often depends on the need of immediate interventions to control and prevent health-related events under surveillance (public health relevance) (8).

### Stability

Surveillance systems are ongoing systems, which collect data periodically. Consequently, it is important that such systems are reliable and permanently available. These are seen as important aspects relating to stability. Reliability in this context means, that the system is finally able to report data properly without failure, and availability means, that the system is able to operate especially when it is needed (8).

In addition, Krause formulated two further attributes of surveillance systems (9):

### Utility

The utility of surveillance systems is an important attribute, because the establishment and maintenance of a surveillance system comes along with ongoing effort. This is only justified if the utility of systems is obvious (9). Utility can be figured out by assessing the usefulness of results in direction of its use to provide necessary information, to implement or to evaluate interventions (9).

### Legal and ethical considerations

Nowadays, legal and ethical considerations are often discussed and are highly important for Health Sciences. Surveillance systems face issues regarding ethics, personal and medical confidentiality (9). Therefore these systems should always act along ethical and legal issues and it is recommended to obtain ethical and legal approval from corresponding independent committees (9).

## 1.3 Strengths and limitations of surveillance systems

### Strengths

The major strength and in itself an important feature of surveillance systems is that this kind of ongoing research over a longer period of time enables tracking dynamic processes and trends over time (7). Therefore, the detection of increases in adverse health events (e.g. through incidences and prevalences) can alert health agencies and can underline the need for further, in-depth investigations (1). In addition, surveillances systems can also be helpful to evaluate interventions. This relates to the fact that periodical data help to identify progress, successes and failures, even if more detailed studies are needed to evaluate programs adequately (1,7).

In line with these strengths, surveillance systems are useful to detect signals and hints in development and spread of diseases or health behaviours and by that, provide basic information on epidemiology of health-related issues. Building on those results, new in-depth epidemiological hypotheses can be generated, questions for further research will be formulated or even participants for upcoming studies can be identified (1,7). Consequently, surveillance systems link research investigations by providing important information for further investigations (8).

Owing to the fact that observation and intervention are strongly related to each other, surveillance systems can easily adapt to new upcoming health problems. This is caused by changes in information need about new health issues. Timely adaption compromises methodology of data collection as well as dissemination of results (7). Particularly in comparison to epidemiological studies, as these are usually time-limited, complex and not timely (e.g. cohort studies, case-control studies), flexibility is one major advantage (6).

### Limitations

Although, surveillance systems have several strengths, the acceptance of these systems by officials and the public has been low in recent years. One explanation might be, that understanding of the methods and results of surveillance systems were inappropriate and by that, the use of information was also low (2).

Moreover, during acute outbreaks of (infectious) diseases, information is needed rapidly to react properly and promptly. Nevertheless, information of surveillance systems might also be delayed in outbreaks, even if these systems are timely (7). Especially in these situations but also in general, administrative and time expenditure for ongoing surveillance systems are high and therefore, costs and benefits have to be balanced (7).

Furthermore, prevalences and/or incidences of diseases can pose problems for surveillance systems. On the one hand, rare diseases are often not in the focus of surveillance systems and due to that, no information about trends are investigated (7). On the other hand, common and less severe diseases are always not fully reported. Hence, the number of unreported cases might be high on national and international level (2,7). Consequently, incompleteness in the direction of validity of results is often discussed (7).

As for any investigation, bias and errors have to be taken into account and can be introduced at any stage (8). For example, low quality of data, partly due to changes in reporting practices over time as well as incomplete or different reporting of cases can lead to (selection) bias and misclassification and in turn to misleading conclusions (7,8). These biases are difficult to control due to the fact that reporting can vary unsystematically over time. Furthermore, non-response as well as self-reported information in surveys, if these are used for surveillance systems, can also pose further problems in the direction of bias and misclassification (3). However, reporting bias due to social desirability of self-reports is assumed to be stable over time (10).

Surveillance systems monitor health-related issues but do not strive to collect all-embracing data. In turn these systems sometimes face a lack of in-depth information (8). Consequently, surveillance systems are valuable in generating hypotheses and formulating questions but not in testing hypotheses (7). In line with this, surveillance systems often concentrate on cases and by that do not provide a comparison group of people without the event under surveillance (8).

In summary, surveillance systems are an important tool to monitor health-related issues to provide information about trends and to identify new-upcoming problems even if these systems collect superficial data and do not go into too much detail.

# 2. SURVEILLANCE OF STUDENTS' HEALTH BEHAVIOURS

Surveillance systems to monitor students' health are important analysis instruments to plan and evaluate health-promoting interventions; especially under consideration of the Public-Health action cycle. This concept covers four levels of implementation and maintaining of interventions (mainly: assessment, policy, development, assurance and evaluation) (11,12). In detail, such surveillance systems provide basic but nonetheless essential information. As part of the assessment of the initial situation, such systems provide data to describe students' current health situation. If health promotion interventions are already running, ongoing surveillance systems can help to evaluate the effectiveness of such interventions (12).

In this context, surveillance systems monitoring students' health can be linked to the framework of health-promoting universities of the World Health Organization (WHO). The key objective of this framework is to promote a healthy and supportive working and learning environments for students. To make this possible, existing and up-coming health initiatives for students should be combined to a comprehensive approach (13).

To meet these needs, Gusy (2010) formulated four requirements of health behaviour surveillance systems at institutions of higher education (11). *First,* complete assessment of health and also health behaviours with its negative and positive aspects; *second,* collection of university-setting parameters; *third,* development and evaluation of models to figure out the impact and relationship between curbing plus fostering factors and positive as well as negative facets of health; and *finally*, establishment of long-term investigations that help to collect data on a regular basis in order to analyse trends (11). However, the establishment of such complex systems, which strive to fulfil each of these four requirements, is complex. Therefore, research projects at universities about students' health often start in small scale, with specialised focus or different depth (12).

## 2.1 Existing surveillance systems of students' health in Germany

Students are often part of representative investigations that explore diverse health issues in the general population [e.g. Federal Health Monitoring Systems (e.g. "Gesundheit in Deutschland aktuell"), Epidemiological survey of substance abuse, German Health Interview and Examination Survey for Adults (DEGS); to mention but a few] (14–16). These investigations do not primarily strive to investigate students' health. However, if results are provided for corresponding age groups and stratified for educational background, this could help to better interpret and classify students' health in comparison.

Although there are representative and longitudinal studies monitoring students, only some of these gather health-related information. For instance, the social survey is a well-established periodical survey and has existed for 60 years in Germany. It is conducted by the German student union (17). In a few words: A representative group of students participate every three years in a postal survey (17). For example in 2012, 12,859 students sent back a complete paper-pencil questionnaire which corresponds to a response of approximately 28% (17). The focus is on students' economic and social situation. This includes topics like studies, social and demographic parameters, financial situation, time amount for studies and employment as well as studies abroad or satisfaction with housing (17). Due to this thematic targeting, no information about students' health and health behaviours are available.

Next to it is a further periodic investigation surveying students in German. This survey is called HISBUS. In brief, HISBUS is an ongoing online-access panel, by which representative data is collected routinely among students, who are part of the panel (18). The panel currently consists of approximately 22,000 students (19). HISBUS surveys focus on topics relating to education and higher education policies (18). In contrast, there are extraordinary surveys with regard to health of students on an irregular basis. For example in 2010 / 2011, the HISBUS panel asked about kinds of stress compensation and strategies to improve performance, mainly brain doping or substance abuse (20). Also in 2012, parts of the HISBUS panel were used to investigate stress experiences of bachelor students relating to studies or daily life (21). Unfortunately, these are ad hoc surveys, which only take place once and consequently do not deliver information about trends.

Besides, there is a an ongoing investigation monitoring substance abuse of a representative sample of 12 – 25 year old adolescents and young adults (e.g. consumption of alcohol, tobacco and illegal drugs) (22). This periodic investigation is called Drug Affinity Study and exists since 1973 (22). It analyses current prevalences of health-risk behaviours as well as trends (22). In 2011, 5,001 adolescents and young adults participated in a computer-assisted telephone interview (response. 60.9%) (22). Although, students are part of the sample (18%), this investigation does solely focus on students up to a maximum age of 25 years (22). Therefore, data might not be representative for students in Germany, but might give important information about this age group. Additionally, this investigation exclusively focuses on substance abuse, which is just a part of health-risk behaviours.

Up to now, these periodic surveys do not provide long-term information about students' health at universities. However, there are single investigations at universities, which

strive to examine students' health or even explicit health-risk behaviours (23–26). One of these is a cross-sectional study investigating first year university students at the University Marburg in 2005 (24,27). A sample of 1,319 medical students filled in a paper-pencil questionnaire, which was administered during courses within the opening eight weeks of their first semester. More than 90% of those who attended courses participated. Multiple health behaviours were investigated relating to fruit and vegetable consumption, exercise, smoking as well as binge-drinking (24,27).

A further example of can be found at the University of Education in Heidelberg (25). 767 out of 46,000 students participated in a web-survey in January / February 2013. Themes of this survey were: socio-demographic characteristics, several indicators of health, resources and demands of the study situation, health and health-risk behaviours as well as laboratory equipment, catering and child care at the university (25). To my best knowledge, no follow-up surveys are planned. [1]

Additionally, there is an ongoing study to evaluate the efficacy of a web-based "social norms" intervention aiming to prevent and reduce substance abuse among students in four regions of Germany. This project is called INSIST (ISPI for students). In brief, the basis of this project is an extensive web-based survey relating to students own substance use and personal estimations of substance abuse of peers. Both will be used to develop and provide a corrective feedback. To evaluate the efficacy of the feedback on students' behaviour, behavioural changes will be assessed by a second web survey. The INSIST study is a multi-centre study, which takes place at eight German universities (e.g. HAW Hamburg; four intervention groups and four control groups) (26).
The cross-sectional baseline survey of this study can provide helpful information about students' health. However, the second survey is not as helpful to describe students' health due to the fact that this is an intervention study and in turn, students' behaviour might be influenced by it. Therefore, exclusively for this master thesis, this project is seen as a single report of students' health at universities.

Up to now, there are some investigations at institutions of higher education, which explore or even monitor students' health behaviours, but well established surveillance systems monitoring students' health are rare. To provide an overview, surveys with at least one follow up are presented in **Table I-1** and will be briefly described in the following.

[1] This project was carried out by means of the project team of the "Gesundheit im Studium" project at the "Freie Unviersität Berlin" (25).

**Table I - 1:** Surveys of students' health behaviours in Germany with at least one follow-up presented in chronological order

| Name | **"Bielefelder Gesundheitssurvey"** (28–30) | **"Gesundheitssurvey für Studierende in NRW"** (31,32) | **"Gesundheit im Studium" (GIS 1/08)** (33–35) | **"Gesundheit im Studium" (GIS 1/10)** [4] (36,37) | **Lübeck University Student Trail (LUST)** (38,39) |
|---|---|---|---|---|---|
| **Investigators** | Stock & Krämer | Meier, Milz & Krämer | Gusy & Drewes | Gusy et al. | Kötter et.al. |
| **Involved universities** | University Bielefeld | 12 Universities and 4 Universities of Applied Sciences in NRW | "Freie Universität Berlin" | "Freie Universität Berlin" | University of Lübeck |
| **Study Design** | Longitudinal study | Cross-sectional survey | Longitudinal study | Longitudinal study | Longitudinal study |
| **Single-centre vs. multi-centre study** | Single-centre study (Expanded afterwards[1]) | Multi-centre study | Single-centre study | Single-centre study | Single-centre study |
| **Time** | B: 1995 – 1996<br>FU: 1997 - 1998 | B: 2006 - 2007 [3] | B: 01 - 02 / 2008<br>FU: 07 / 2008 | B: 01 / 2010<br>FU: 06 / 2010 | B: 2011 / 2012<br>FU: planned |
| **Sample size** | N=650 (B) / N=166 (FU) [2] | N=3,306 (B) | N=2,115 (B) / N=808 (FU) | N=2,413 (B) / N=954 (FU) | N=891 (B) |
| **Baseline response** | 85% (28) | 87.9% (31) | 7.8% (35) | 9.2% (36) | 60.8 % - 93.0% (39) |
| **Study Instrument(s)** | Paper-pencil questionnaires (FU: Also Biomedical examinations) | Paper-pencil questionnaires | Web-based questionnaires | Web-based questionnaires | Paper-pencil questionnaires |

B stands for Baseline, FU for follow-up and NRW for North-Rhine-Westphalia. [1] The underlying concept of the "Bielefelder Gesundheitssurvey" was transferred to further European universities (40). [2] Additional international students were examined (n=204) during the follow-up (29). [3] No FU was carried out for the "Gesundheitssurvey für Studierende in NRW". The rationale for presenting it was its strong connection the "Bielefelder Gesundheitssurvey". (31). [4] GIS01/10 was based on GIS 01/08 with regard to study design and methodological realization.

### "Bielefelder Gesundheitssurvey"

To my best knowledge, the first longitudinal survey of students' health in Germany is called "Bielefelder Gesundheitssurvey" and started in 1995/1996. 765 university beginning students were asked to fill in a paper-pencil questionnaire during their introductory session at the University Bielefeld (30). The aim of this survey was to examine health, well-being and attitudes of students as well as health behaviours in order to investigate the need for work-site related health promotion at universities (29). Moreover, a follow-up investigation was performed consisting of a paper-pencil questionnaire and supplemented by biomedical examinations.

Numerous research activities resulted from this survey. Since 1999, baseline as well as follow-up surveys were conducted at further European universities [Bulgaria (B: 2005), Denmark (B: 2005), Lithuania (B: 2000 & FU: 2004), Poland (B: 2005), Spain (B: 1999 & FU: 2001) and Turkey (B: 2004)] (40). In 2005, 102 students from eastern Europe and 159 students from Germany (peers control group) were surveyed to explore psychological health, perceived stress, resources and demands (41).

### "Gesundheitssurvey für Studierende in NRW"[2]

Furthermore, the previously mentioned "Bielefelder Gesundheitssurvey" built the basis for a multi-centre survey in NRW. In 2006/2007, 12 universities and 4, randomly selected, universities of applied sciences took part once in the "Gesundheitssurvey für Studierende in NRW". The aim was to investigate complaints and health behaviours of students in relation to sex and course of studies. Moreover, the impact of universities on students' health was in the focus of this research project (31). Therefore, several themes were covered: course of studies, general aspects of health, impairments and diseases, behaviours and attitudes and accidents; to mention but a few (32). 3,306 students filled in paper-pencil questionnaires which were administered during courses (31). The study achieved an average response proportion of 87.9% (range: 69.3%-100%) of those who attended courses. However response at universities of applied sciences was higher (97.6%) (31).

### "Gesundheit im Studium" (GiS 01/2008 and GiS 01/2010)

A survey was elaborated at the "Freie Universität Berlin", which is called *"Gesundheit im Studium (GiS)"*. Apart from attitudes towards studies, subjective health, perceived study conditions and resources, this survey strived to examine health behaviours and aspects of educational background of students. A random sample of 10% of all students at the "Freie Universität Berlin" were invited to participate in a web-based survey in 2008 (33).

[2] Although no follow-up investigations were performed, this investigation was mentioned due to its strong relation to the "Bielefelder Gesundheitssurvey".

By reason of a moderate response, voluntary participation was also allowed afterwards (33). [One comment, this methodological decision needs to be tempered with caution, because selection bias might have strongly influenced results.] Two questionnaires were elaborated. One focussing on students' health behaviours and one on educational background. Due to the length of both questionnaires (31 and 25 minutes), participants randomly received one or the other (33). Nevertheless, only 52.2% of students who initially started to fill in the questionnaires remained until the end. This was probably by reason of its length and complicated matrix questions (33). In addition, this might have also increased selection bias. Finally, 6.2% (n=2,115) of enrolled students at the "Freie Universität Berlin" participated (33). This corresponds to 7.8% relative to those students who were invited to fill in the web-based survey (35). A subgroup of 808 students took also part in the follow-up survey which was administered after 6 months (34).

Additionally, this online survey was repeated in 2010 (36). All methodological aspects were maintained, except recruitment of students. In 2010, *every enrolled student* was invited to participate via email. The proportion of those who filled in the questionnaire completely was lower (45.6 %), although slightly more students participated [9.2 % of enrolled students (n=2,413)], (36). Nevertheless, selection bias might still play a role.

Besides, an extraordinary cross-sectional survey was elaborated. 8,797 bachelor students of the "Freie Universität Berlin" were asked about topics like burnout, perception and valuation of their study conditions and time spend for studies (response: 11.5%) (42).

In general, the project team of Gusy at the "Freie Universität Berlin" provide help to translate the concept of this students' health survey to other universities in Germany or to establish comparable research investigations on students' health. This encompasses help during the conceptual development and support for implementation (43). One example is the before mentioned investigation at the University of Education in Heidelberg (25).

### Lübeck University Student Trail LUST

The latest research project is the LUST study. A single centre, prospective, observational study at the University Lübeck. This study strives to annually survey a cohort of students from their enrolment onwards (38). The aim of the study is to figure out characteristics and factors which positively influence the development of students' health (38). Therefore, the instrument comprised self-rated general and mental health as well as potential predictors for health outcomes (e.g. study-related behaviours and experiences) (39). This paper-pencil baseline survey took place during the pre-course week of the winter semester 2011/12 and 2012/13. All medical as well as students of science, technology, engineering and mathematics were asked to participate (39). The baseline instrument took 30 minutes,

whereas shorter web-surveys for follow-up examinations were planned (39). Response varied between 93.0% for medical students and 60.8% for the others (39). No specific information about follow-up investigations were published so far.

## 2.2 Establishment of surveillance systems monitoring students' health

In order to establish health behaviour surveillance systems e.g. to monitor students, it is important to take different aspects into account, while keeping the aim and the previously described requirements of surveillance systems in mind: First, the objective of the project; second, information needed for the intended users and third, the optimal mix of surveillance attributes, which were described in the early beginning of this thesis (1).

In 2014, the CDC published a guide for conducting a Youth Risk Behaviour Survey at schools as part of the Youth Risk Behaviour Surveillance System in the United States (44). On account for the fact that this guide is for schools, it has to be adapted for universities. Nevertheless, it offers a good orientation for the establishment of surveillance systems in this setting. Besides, the recommendations of Good Epidemiological Practice of the German Society of Epidemiology is a further basis for the establishment of a surveillance system, even if it is originally developed for classical epidemiological studies and does not fit perfectly to surveillance systems (45).

On the basis of the above, scientific considerations for the establishment of a health behaviour surveillance system were elaborated. This is necessary to obtain the best possible information about prevalences and trends of students' health, ensure rigour of the investigation and achieve transferability.

### Objective of the surveillance system

Within the early phase of the establishment of a surveillance system it is mandatory to have an explicit and realizable objective, like it is true for every epidemiological investigation (45). Such objective is the fundamental pre-requisite for the planning and evaluation of the investigation as well as its study instruments (45).

### Specific target group

In general, the selection of the study population must be justified on the basis of the objective (45). Hence, students at universities are the target group for surveillance systems, that strive to monitor their health behaviours. Further considerations of sampling procedures are necessary because these strongly influence the representativeness, quality and usefulness of results, which are all attributes of surveillance systems (8,44). Therefore, the study sample has to be clarified more in detail to achieve scientific standards. This

includes the following aspects: Which subjects of studies are of interest, which cohorts should be monitored and moreover, which scientific sampling procedure should be used. Inspired by the CDC guide, there are mainly two sampling procedures, which are appropriate for surveillance systems at schools or even universities. First, surveillance of a census of students, which means monitoring all students, or second, surveillance of a scientifically and randomly selected sample or clusters of students (e.g. seminars, cohorts) (44). This is necessary to obtain representative results for the entire student population and to accurately represent health-events under surveillance. (8,44).

### Permissions to conduct the survey (as part of the surveillance system)

Legal and ethical considerations, as these are attributes of surveillance systems, have to be taken into account during planning and conduction of this kind of research. In accordance with the German Society of Epidemiology it is mandatory to respect human dignity as well as data protection regulations in order to protect the right of informational self-determination. Therefore, approval of an independent ethics commission should be obtained (45). Moreover, the CDC recommended to secure permission to conduct surveys from governing body of the institution (44). A detailed study protocol should be prepared in this context. Such a scientific study protocol should provide statements relating to the following aspects: (a) The research process regarding the rationale of the project, (b) description of data collection processes concerning when, where, how and by whom the survey will be administered, (c) ethical and legal issues to guarantee confidentiality of the institution and anonymity of participants and (d) description how results will be used (44).

Before students participate, written or even oral information about the surveillance system are needed to assure voluntary participation regarding to the right of informational self-determination (see 3.2 Administration procedures) (45).

### Instrument development

The development of a realizable data collection instrument is based on the underlying research question. Owing to the fact that ensuring high quality begins with high quality questions, this project phase is highly important (3,8,45).

Self-reported questionnaires are often used in case of a surveillance systems monitoring health of students. However, self-reported answers tend to be limited considering information bias which could result in inaccurate answers of participants (10). Especially relating to sensitive questions, truthful answering influenced by social desirability (reporting bias) might pose a problem for researchers (46). Although bias have to be considered,

it is unlikely that any bias will change over time (10). Therefore statements about trends in students' health can be made also based on self-reports.

Apart from that, different methodological approaches of questionnaires are available. Often approaches differ with regard to the mode of the instrument (web-based vs. paper-pencil-based surveys) or with regard to the setting, where questionnaires will be completed (home vs. university) (47). As a rationale to decide which mode and setting would be the best, Brener et al. (2006) recommend to select the one which achieve highest prevalence estimates of health risk behaviours. This is based on the previously mentioned fact that self-reported sensitive behaviours are often underreported (47).

Keeping this in mind, different aspects will be discussed regarding mode and setting of data collection. Actual and perceived anonymity and privacy of participants are critical factors in reporting health behaviours of students. This applies even more if illegal and/or socially stigmatizing activities are considered (48,49). Several bias could be introduced if these aspects are not adequately satisfied (49). A recent study showed that setting of data collection influenced prevalence estimates. Especially for illegal or socially stigmatized health behaviours, estimates are higher in school-based settings than in the home-based settings (e.g. tobacco, alcohol and drug use) (48). In this context, mode of questionnaires are also important to consider. On the one hand, students who filled in a paper-pencil questionnaire felt more comfortable relating to privacy and anonymity of their responses compared to those who completed web-surveys (both administered in classes) (49). This was mainly due to the fact that, web-respondents were afraid that others could see their answers. Same was true for students who filled in a web-survey on their own (49). On the other hand, Brener et al (2005) showed that computer-assisted instruments increased prevalence estimates. Nevertheless, the authors suggested to use paper-pencil instruments at schools rather than computer-assisted instruments, because those only complicate logistics and increase costs (47). Besides truthful reporting of health behaviours, participation in surveys is of high significance. It was shown that response of web-based instruments were remarkably low (28% vs. 90% or higher for "in class" administrated instruments) (49). Beyond low response, web-based instruments ended up with impaired data quality (higher amount of missing or implausible data) (49).

Although these previously mentioned studies were investigated at schools, results might be transferrable to universities. The paper-pencil-based survey at universities and universities of applied sciences in North-Rhine-Westphalia ("Gesundheitssurvey NRW") achieved an effective response rate of 69.3% up to 100% among those who attended courses (31). In comparison, web-based surveys at the "Freie Universität Berlin" ("Ge-

sundheit im Studium") ended up with a response rate of 7.8 % in 2008 and 9.2% in 2010 (35,36). Students at the HAW Hamburg were recruited to fill in web-based survey about substance abuse, as part of the INSIST study. Even if a mixture of several methods (e.g. information via e-mails, lecturers or Facebook) were applied, only 6.2% of currently enrolled students were recruited within 18 weeks, whereas the highest response was achieved among Health Sciences students (18.6%) (50).

Apart from this discussion, there are also disadvantages of paper-pencil questionnaires; namely computer-assisted instruments would eliminate the need of transferring data in computer-readable formats; would simplify completion of questionnaires by use of skip-patterns and interactive presentation, and also would allow real time plausibility controls (51).

Independently of mode and setting of the instrument, it is highly important that the instrument is as accurate and complete as possible (1,45). All items of interest should be defined precisely and have to be developed as much as possible according to professional standards to assure sensitivity of the instrument and by that of the surveillance system (45). Besides, it is meaningful to use common definitions to achieve equivalent information of students' health to link results to other investigations (11).

Decisions about themes and contents of the instruments have to be taken while facing the primary methodological challenge of surveillance systems: The balance between information needed and the limits of feasibility (1). Therefore, the principle of data economy plays an important role. This means focusing on necessary data, because too many questions may contribute to boredom or fatigue and could cause students to give inaccurate and/or incomplete responses (9,44). This would endanger data quality due to missing values and acceptability of the survey, which is highly important for ongoing surveillance systems that strive to collect data periodically over years (9). These theoretical recommendations can be underlined by practical experiences of the GiS surveys. Approximately 56% of those who started to answer the students' health questionnaire filled it out incompletely; mainly due to its length and complicated questions (33,36).

To sum it up, short questionnaires with a limited number of questions are needed, that focus on health-behaviours of highest priority, by use of precise questions to measure occurrence and frequency of those behaviours (3). Gusy (2010) elaborated an overview of themes which are considered in current surveys at universities or which are worth enough to reflect in new-upcoming ones (**Table I-2**) (11). Although it was recommended to cover all, the establishment of an all-embracing systems is complex. Hence, investigations at universities often start with specialised focus as well as different depth (12).

**Table I - 2:** Themes of surveillance systems monitoring students
[based on Gusy (2010) (11)]

| Themes | Sub-themes |
|---|---|
| **Positive and negative components of health** | - Pathogenic characteristics<br>  - Physical disorders (e.g. impairments, diseases, accidents)<br>  - Mental disorders (e.g. depression, burn-out)<br>- Salutogenic characteristics<br>  - Physical and psychological well-being / quality of life |
| **Health behaviour** | - Tobacco consumption<br>- Alcohol consumption<br>- Binge-drinking<br>- Illegal drug consumption<br>- Medication consumption<br>- Nutrition<br>- Physical activity (e.g. sports with health benefits and risks)<br>- Willingness to change health-risk behaviours<br>- Sexual behaviour<br>- Capacity for recreation and relaxation |
| **Study situation / conditions** | - Macro-level characteristics of universities (e.g. material and human resources)<br>- Demands, resources and well-being under consideration of study conditions (e.g. expenditure of time, condition of studies, social support during course of studies, attitudes about studies) |
| **Personal prerequisites** | - Individual resources to manage studies (e.g. time, financial resources, social support, personal attitudes)<br>- Biographical characteristics (e.g. age, nationality, sex, subject and period of study )<br>- Current life situation (e.g. accommodation, income, partnership )<br>- Social situation (e.g. social status, education background)<br>- Weight and height<br>- Demand and supply of consultation at universities (e.g. Regarding study-related problems or stress management) |

### Time of conduction

Next to the specification of data collection instruments, thoughts about time of conduction of the survey are essential due to the implications on response. If in-class administered questionnaires would be used, time of conduction should be decided in consideration on the presence of students at seminars. Both, presence of students and response, strongly influence the representativeness of the survey and by that of the surveillance system (44). Inspired by the recommendations of CDC for paper-pencil surveys at school, dates for the survey should be carefully planned. Researchers should consider dates where presence of students is assumed to be high and by that should avoid the conduction of surveys on Mondays or Fridays, before or after holidays, during the last month of the term or at any time when student attendance is assumed to be extraordinary low (44). Apart from that, it is recommended to administer the survey ideally on the same day or during the same week to keep the data collection period as short as possible (44).

### Administration procedures

To ensure high data quality, the data collection process is a sensible phase and survey administrators should use standardized procedures (3,44,45).

Practical field experiences has shown, that informing teachers about the study before data will be assessed during classes is worth and partly help to increase response and acceptance of the survey (23). Therefore, this can be recommended to be included into standardized administration procedures.

Foremost, rules for and comments on the conduction of each step during the data-collection phase should be fixed in a written data collection handbook to increase standardisation and comparability, especially if various survey administrators are involved in the ongoing project (44,45). These scripts should cover the following aspects: Standardized introduction of the survey administrators and the survey itself, emphasis on privacy and anonymity, instructions for use of the questionnaire and the collection of completed questionnaires (44).

Besides, the CDC highly recommended that that survey administrators should operate along standards to protect confidentiality and anonymity of students (44). This is essential, because actual and perceived anonymity affect students response rates and data quality (48,49). According to the CDC guide it is worth to distribute questionnaires with blank envelopes to provide a possibility to cover answers on the questionnaire and by that, to increase anonymity. Finally the completed questionnaire should be put into the envelope and placed into a large box (44). This methodological consideration can be underlined by results of Dietz et al. who investigated cognitive-enhancing drug use among

students (23). Although this is a highly sensible topic, the authors achieved a response rate of 90.7 % (23). Among other considerations to increase anonymity, increased response was partly due to an highly anonymous questionnaire administered in courses and which was placed in a box at the end of the class by the participants themselves (23).

### Survey administrators

Next to considerations about administration procedures, the selection of survey administrators is crucial. Due to its implications on response and data quality, these persons must be able to make students feel as comfortable as possible while establishing an atmosphere of trust with regard to the contents of the questionnaire as well as anonymity of provided information (44). The CDC recommended several groups of persons as most suitable: School nurses, psychologists, social workers as well as graduate students who are interested in sciences (44). Independently of their occupational background, all persons involved in data collection processes should be trained prior to the field work to achieve extensively skilled survey administrators (45). In accordance to the CDC, such trainings should cover the purpose of the survey (including the overall goal of the surveillance system), the schedule for administering the survey, survey materials, importance of safeguarding students privacy and how results will be used (44). Confidence with regard to all mentioned aspects will help survey administrators during data collection periods. If extensive trainings are not feasible, the CDC suggested to provide comprehensive written instructions about these aspects by help of a data collection protocol (44).

To increase confidentiality of participants and the project, survey administrators should sign a standardized assurance of confidentiality. Such a declaration should cover confidential handling of names of respondents, if necessary, and of all information during the data collection period as well as confidential handling of data, including preventing access to survey data by others (44).

### Analysis of data

The establishment of a surveillance system should also comprise a detailed concept for compilation and management of data. The German Society of Epidemiology recommended to develop a detailed concept which covers data editing, plausibility verification and coding of data, as well as information about data transfer (45). To assure secure and prompt compilation of data, questionnaires have to be transferred into the corresponding database by either manual entering via an data entry tool or by scanning computer-readable questionnaires; whereas the first method is suggested to be more efficient for small samples (44,45). Afterwards, data plausibility verification and careful data editing have to be carried out (44,45). These processes will be repeated constantly in a surveil-

lance system. To ensure standardization relating to verification procedures after each data collection period of the ongoing surveillance system, standards of data plausibility controls should be elaborated. Recommended by the German Society of Epidemiology, all raw data sets should be saved independently from edited and revised files. Furthermore, analysis of epidemiological studies under consideration of adequate methods and without unreasonable delays is essential (45). This is particularly important under consideration of timeliness of surveillance systems, which is one of the most important attributes.

### Dissemination of results

The utility of surveillance systems is assessed by the usefulness of results (9). Based on that, effective reporting of useful results about students' health behaviour are essential with regard to qualified risk-communication to the interested public (44,45). By that, researchers should prioritize the target audience by assessing their interest in and knowledge of health and health risk behaviours among youths (44). For example, administrators or university board members can use results to guide and develop health policies. Agencies working with students can make use of it to evaluate and improve their programs (44). Furthermore, a surveillance system strive to be accepted by the public which is indicated by the amount of results used by others (8). To reach a variety of audiences with varying degrees of interest and technical understanding, vocabulary, graphical presentation and styles of dissemination of results should be considered (44).

### Policy of sharing data

In line with dissemination of results, sharing data with others might increase acceptability of the surveillance system. Hence, a policy of sharing data should be elaborated in advance (44). It is of high importance that privacy of students is considered and by that, data is anonymized and will be exclusively shared to the purpose of scientific research after a written standardized assurance of confidentiality will be signed (44,45).

### General remark in terms of consistency

Relating to an ongoing surveillance system, researchers should try to keep methodological considerations constant over years to ensure comparability of results. If, despite this, changes in any aspect of the surveillance system should be necessary, potential effects on participation, data quality, perceptions of privacy and anonymity, and prevalences should be reflected carefully beforehand (49).

# 3. STUDENTS' HEALTH BEHAVIOURS AND HEALTH RISKS

## Perceived health status

The health status of university students is generally perceived as good (32,39). 90.9% of medical students and 79.7% of science, technology, engineering and mathematics (STEM) students, who participated in the LUST study in Lübeck rated their current general health as good (39). In NRW comparable results were shown (32). Regarding mental health, a high proportion of participants of the LUST study were neither depressive nor anxious (Medical students 88.3%; STEM students 86.3%). This corresponds to a generally good mental health status (39). Even though, perceived health as well as mental health status is assumed to be good among students, this group is particular prone to stress and might experience it because of academic obligations, financial pressure and lack of time management skills (52).

## Health-promoting behaviours

### *Nutrition*

Nutrition generally influences health and due to that fruit and vegetable intake per day is assumed as one indication for a healthy lifestyle (53). The German society of nutrition as well as the World Cancer Research Fund & American Institute for Cancer Research recommend at least five servings of fruit and vegetables per day (53,54). However, 96.3 % of the students at the University Marburg, who participated in the health survey, eat less than the recommended five servings per day, whereas women ate slightly more fruits and vegetables than men (24). Comparable results were also shown by Gusy et al (2010) (36), although 65.3% of these students assessed their nutrition as healthy (33).

### *Physical activity*

In general, university students are physical active, whereas variations can be seen in Germany, partly due to different definitions (24,25,32,33,36) [3]. In Heidelberg, 70 % of the participating students are physical active while the prevalence is slightly increased among women compared to men (72.5% vs. 69.6%) (25). Gender differences could also be seen relating to the frequency of active sports. Male participants practiced active sports more than four times a week (37.8%) whereas their female peers did it twice a week (28.8%) (25). Although students are generally physical active, 16% of surveyed students in Marburg reported to do no physical activity at all (24).

[3] Definitions of physical activity varies from general approaches relating to at least 3 times of at least 20 minutes of vigorous physical activity (24), through definitions of physical activities which increases pulse and breathing (25,32) to detailed definitions, like asking for mild, moderate or vigorous activities as well as sports separately (33,36).

*Influenza vaccination*

In this thesis, influenza vaccination is assumed as one indicator of health-promoting lifestyle, in the direction to protect oneself against seasonal influenza. Less is known about vaccination among university students and, to my best knowledge, none of the described surveys investigate this topic. One hint for influenza vaccination coverage in comparable groups was presented by the Robert Koch institute as a result of the "Gesundheit in Deutschland aktuell" study. 18.9 % [95% confidence interval (95% CI): 14.7% - 24.0%] of better educated women aged 18-29 years, who participated in this telephone survey, and 13.2% (95% CI: 9.0% - 18.8%) of corresponding men have been vaccinated against seasonal influenza in the winter season 2008–2009 (14).

## Health-risk behaviours

*Tobacco smoking*

Apart from unhealthy nutrition and less physical activity, tobacco smoking is the most important risk factor for chronic diseases and by that one of the main causes for morbidity and mortality in industrialized countries (55). According to the Drug Affinity Study, smoking prevalences among 18–25 year old participants of the general population decreased markedly between 1973 and 2011 from 63% down to 37%. Relating to daily smoking, students reported in this study to smoke less frequently than their peers (13.0% vs. 23.1%) (56). However, prevalences of regular smoking varies between universities (GiS 01/2010: 19.5 %; Heidelberg: 9.4%) (25,36). Moreover in the Berlin cohort, regular smoking is more common among male students the compared to female students (22.8% vs. 18.0%) while occasional smoking is similar between sexes (13.8% vs. 13.0%, respectively) (36). Also intensity of smoking generally differs between sexes. 10.3% of male students of the GiS 01/2010 survey smoked heavily (≥ 20 cigarettes/day) compared to 5.6% of female students (36).

*Shisha smoking*

Despite the fact that experts warn about health hazards from shisha smoking, little scientific interest has been paid to it (57). Approximately three quarters of students aged 18–25 years, who participated in the Drug affinity study, had ever tried out shisha smoking (56). As a further result of this study, 72.6% of 18-25 year old participants of the general population smoked at one or two days during the last 12 months (56). In contrast, the 30-day prevalence in this group was remarkably lower (11.4%) (56). Even if shishas are smoked less frequently than cigarettes, risks are assumed to be the same (57).

*Alcohol consumption*

A further health-risk behaviour, which is generally common among students, is alcohol consumption. 80.1% of students of the Heidelberg cohort drunk alcohol during the last 30 days. The lowest prevalence was found in freshmen (71.6%) whereas it increased up to 85.4 % in students of the fifth semester (25). Moreover, young adults aged 18–25 years of the general population, who participated in the Drug Affinity study, drunk slightly less often alcohol compared to students of the sample (30-day prevalence: 81.9% vs. 87.1%) (22).

*Binge-drinking*

Binge-drinking played an important role in recent research, but various definitions were used. Due to that, comparability is limited (22,25,32,36) [4]. Nevertheless, binge-drinking is generally common among students. More than 60% of students reported binge-drinking during the last 30 days, whereas prevalences differ slightly between surveys (Marburg: 62.1%, Heidelberg: 64.3%; GiS (01/2010): 66.8%) (25,27,36). However, the 30-day prevalence of binge-drinking was considerably low among students aged 18-25 years of the Drug Affinity Study (42.3%), partly by reason of the underlying definition and the age range of interest (22).

*Substance consumption*

Less is known about *antibiotics* intake among students. To my best knowledge, only one study investigated prescribed antibiotics among students and young adults of the labour force, who were both insured by the “Techniker Krankenkasse” (58). Among 20–34 year old students who participated in this study, 23.2% of all prescribed drugs in 2010 were antibiotics. Antibiotics were less often prescribed compared to young adults of the same study sample (32.5%) (58). Furthermore, in both groups the proportion of prescribed antibiotics increased from 2006 to 2010 (students: + 5.8%, young adults: + 6.2%) (58).

However, intake of *painkiller* was investigated recently at institutions of higher education. 70.9% of students of the Heidelberg cohort took painkiller during the last 30 days and on average at approximately four days (25). Comparable results were found for surveyed students in Berlin (66.7%), whereas only 22.7% of students of the NRW survey took painkiller during the last 30 days (36,59). Reasons for these differences are not clear at all, but might be due to methodological differences, various study subjects at universities or changes over time. Nevertheless, all studies showed existing sex differences (25,36,59). On the one hand, female students who participated in Heidelberg survey reported to use

[4] Binge-drinking was defined as more than five drinks at one occasion for men and women in the Drug Affinity Study, whereas other studies differentiate between men and women (> 4 drinks for women and > 5 drinks for men; GiS, Gesundheitssurvey NRW, University Marburg) (22,25,32,36)

pain killer more frequently during the last 30 days compared to their male counterparts (73.4% vs. 54.4). On the other hand, no differences were seen in the number of pills (25). Relating to the intake of painkiller without prescription, only 23.6% of painkiller were prescribed, while no sex-differences were found in the Heidelberg cohort (25).

Despite of their young age, students also use *tranquillizer and sleeping pills*. 6% of students, who participated in the GiS 01/2010 survey, used those drugs during the last 30 days (36). A similar prevalence was seen in Heidelberg (6%) (25). Only slight sex-differences were presented for corresponding 30-day prevalences (women: 13.4%, men: 12.3%) (35). Furthermore, 3.2% of female students as well as of male students used these drugs on a regular basis (≥ 10 days per month) in the NRW cohort (35). However, the use of these drugs without prescription were remarkably more common among male participants compared to female participants (25.8% vs. 13.9%) (35).

Out of various drugs, only *cannabis* abuse will be described due to the fact that it is the most consumed substance among young adults (60). Researcher of the GiS 01/2010 survey found out that 57.3% of students reported to have ever tried cannabis during their life, but less consumed it in the last year (27.6%) (36). However, students who participated in Heidelberg consumed less often cannabis (Life-time prevalence: 32.2%, 12-months prevalence: 14.6%) (25). These remarkable variations might be possibly due to different subjects of study, assuming that cannabis consume is different at universities with a wide spectrum of subjects compared to universities of education. Sex-specific analyses showed that male students of the Heidelberg cohort reported to consume three times as frequent cannabis in the previous 30 days compared to their female peers (13.0% of vs. 4.4%) (25).

*Pharmacological "cognitive enhancement"*

Pharmacological "cognitive enhancement" (CE) entered research recently and is often defined as substance use to increase mental capacity in healthy individuals (15). As for other health behaviours, definitions differ between studies (15,20,23). The highest prevalence of CE in the general population was reported for participants aged 18-29 years (approximately 3%) (15). Relating to students of the HISBUS panel, 12% used at least one substance to manage their studies since the beginning of their studies, whereas 5% used prescription drugs, painkiller, psycho stimulants or stimulants (20). Due to the fact that topics of CE are quite sensitive, researchers in Mainz assumed that common survey techniques underestimated the use of CE at universities (23). They used an anonymous specialized instrument and reported a 12-month prevalence of CE of 20% (23). As a result, prevalences have to be interpreted with caution under consideration of information bias.

# 4. PUBLIC HEALTH RELEVANCE

After leaving school, most young adults generally leave also their family environment to study at universities. By doing so, they face a transition into adulthood, which might have a strong effect on the development of life-style behaviours (28). This transition includes establishing a college identity, changing social networks as well as environments while facing increased freedom from parental control (61,62). During this time universities play a key role as a setting where students develop independence and learn skills possibly affecting their development (11,63).

Although students are considered to be healthy or even privileged related to health due to their young age and social situation, few studies reported that students' mental health is partly impaired and many students engage in risky health behaviours as this was described before (11,24,25,32,35,36). These undesirable developments influence performance and thus academic success (11). In addition, health-related behaviours formed at young ages (e.g. at university) are difficult to change in later life (62).

Apart from the strong implications on individual health, unhealthy and health- risky life-style of students might have potential influence on population's health. Since students are an important group in society from which future policy makers, professionals and teachers will be drawn, students' health behaviours are even more important if students might later be multiplicators or role models for others (10,24,28,62).

In 2014, approximately 2.6 million young adults currently study in Germany and build one large group in society that is easily accessible at universities (64). However, they are an under-researched group regarding health and health-behaviours, thus far (11,12). As previously described, only few studies were carried out in Germany, which focussed on these topics. Trends in health and health behaviours of the target group have been rarely studied in Germany. Future studies will be necessary to describe and to longitudinal monitor students' health as basis for planning and evaluating health-promoting interventions at universities. These campaigns should set out to promote individual future health and social development of students (11,12,31). The need of information is also growing due to the current reorganisation of academic structures (bachelor / master studies) and their potential impact on student's health and well-being (11).

To sum it up, all of this points to the fact that surveillance of students' health behaviours at universities is of particular importance in the field of public health. However, there are several unanswered questions. Thus, ongoing surveillance systems at universities are needed that provide a data basis to monitor students for years.

## 5. RESEARCH PROJECT

Consequently, the aim of the underlying research project of this thesis is to close this gap of research. Therefore a second generation surveillance system that regularly monitors health and health-related behaviours of Health Sciences students at University of Applied Sciences Hamburg was established.
By empirically examining the current health status of students as well as trends over the next years, the overall objective is to produce a more complete understanding of students' health and to figure out the need of health promotion and prevention for students.

Three research questions motivated this investigation::

1. *How can a health behaviour surveillance system at universities be established?*
2. *Which methodological approaches are likely to be successful?*
3. *To what degree do bachelor Health Sciences students engage in health-promoting and health-risk behaviours in order to decide whether to take action in health promotion and prevention for students?*

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# PART II – MANUSCRIPT

## 7. MANUSCRIPT FOR SUBMISSION TO THE "INTERNATIONAL JOURNAL OF PUBLIC HEALTH"

**Title: Health surveillance at an university for Health Sciences students in Northern Germany: Design and first results**

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**Abbreviations**

| | |
|---|---|
| HAW Hamburg | University of Applied Sciences Hamburg |
| 95% CI | 95% confidence interval |
| CE | Pharmacological "cognitive enhancement" |

**Keywords**

(1) Surveillance system, (2) university students, (3) health-promoting behaviour, (4) health-risk behaviour, (5) health

*(3997 words (footnotes excluded); 4000 words max.)*

## ABSTRACT

### Objectives

The main objective was to establish a second generation surveillance system at an university for Health Sciences students to monitor students' health and to provide first results.

### Methods

Since 2014, an almost complete convenience sample of Health Sciences students will be surveyed twice a year at Hamburg University of Applied Sciences. A paper-pencil questionnaire, that includes questions about socio-demographics, well-being, health-promoting and health-risk behaviours will be distributed during courses.

### Results

Our previous surveys achieved response rates of more than 97% and up to 83% of enrolled students were reached. Undergraduate Health Sciences students reported health-risk behaviours, e.g. frequent binge-drinking (6.2%), regular cannabis use (4.2%), regular cognitive-enhancement (4.0%). Moreover, unhealthy diet was prevalent but almost all students were physically active.

### Conclusions

A short and simple paper-pencil questionnaire administered during courses and conducted according to standardized processes provide complete data on students' health with little effort. Trends can be determined, which assist in making decision whether to take action in prevention and/or to evaluate campaigns. These first results show the need for a more targeted health promotion action for students.

*(180 words; 180 words max.)*

## INTRODUCTION

Surveillance of the health of school-aged children became the focus of research in the previous years in Germany and worldwide [e.g. KiGGS (Hölling et al 2012), HBSC (Roberts et al 2009), YRBSS (Kann et al 2014)]. However, these surveys focused solely on school-aged children, whereby most young adults often face a transition into adulthood when leaving school and their family environment to study at universities (Stock et al 2003). Adaption to new work-load, responsibilities and greater freedom have strong effects on the development of life-style behaviours (Von Ah et al 2004). During this time universities play a key role as a setting where future professionals develop independence and learn skills possibly affecting their development (Abercrombie et al 1998; Gusy 2010). Since 1998, the WHO regional office for Europe launched a framework of health promoting universities (Tsouros et al 1998). Assessment and evaluation of students' health needs is a main prerequisite to create a healthy environment (American College Health Association 2010). Therefore, future studies monitoring students' health are necessary in order to submit all the information necessary for an effective implementation or rather evaluation of health promotion policies and practices at universities (Stock et al 2003).

Nevertheless, university students have widely been neglected in health research; hence data about this group is scarce yet. Mostly cross-sectional rather than long-term investigations were carried out in Germany and Europe (e.g Stock et al 2003; Gusy et al 2010; Kötter et al 2014; Peltzer and Pengpid 2014). In contrast, periodical investigations to monitor student's health behaviours, as well as indicators and perceptions exists solely in the United States of America since 1998 (American College Health Association 2010).

Although students are considered to be healthy or even privileged related to health due to their young age and social situation (Stock et al 2003), recent studies indicated the opposite. Students' mental health is reported as impaired and many students engage in high-risk behaviours like drinking alcohol – or in some cases binge-drinking - smoking and drug use (Stewart-Brown et al 2000; Steptoe et al 2002b; Keller et al 2008; Lohmann et al 2010). Few years ago, disappointing trends of students' health were described in Europe. This included decrease in daily fruit consumption, increase in smoking prevalence and fortunately, slight increase in physical exercise (Steptoe et al 2002a). Overall, these undesirable developments influence performance and thus academic success (Gusy 2010).

Consequently, the primary goal of this research project is to establish a long-term health surveillance system of Health Sciences students in Germany with the opportunity to monitor trends of the most relevant health-promoting and health-risk behaviours over time.

Three research questions motivated this investigation: (i) How can a health surveillance system at universities be established?; (ii) Which methodological approaches are likely to be successful?; (iii) To what degree do undergraduate Health Sciences students engage in health-promoting and health-risk behaviours in order to inform health professionals or policy makers whether to take action in health promotion for students?

## METHODS

### Study Design

A second generation surveillance system to monitor students' health and health-related behaviours was established at Hamburg University of Applied Sciences (HAW Hamburg) in the department of Health Sciences (Faculty of Life Sciences). This prospective health surveillance system includes periodic cross-sectional surveys that will be conducted each semester.

### Target group

The target group consisted of matriculated undergraduate Health Sciences students at HAW Hamburg from the first to the fifth semester. Additionally, students had to be at least 18 years old and sufficient German skills were needed. Other inclusion/exclusion criteria were not applied. A convenience sample of these students was used and the number of enrolled students predefined the study size [1].

### Time frame

During the summer semester 2014, we carried out the pilot survey in order to test methods applied for recruitment, data collection and data management. After adaptations were performed, the first standardized survey (first survey) of the health surveillance system was carried out during the winter semester 2014/2015 and will be continued for semesters ahead.

### Recruitment

Recruitment was performed during courses of each cohort. To achieve an almost complete sample, the recruitment was conducted during the first third of the semester (lecture period of 17 weeks). A skilled study team selected well-attended courses and recruited students present during courses.

[1] If not further specified, students are standing for undergraduate Health Sciences students.

### Data collection

Self-administered paper-pencil questionnaires were distributed and completed directly during courses. Completion of the questionnaire took approximately five minutes. For ensuring anonymity, participants folded completed questionnaires to cover answers and placed these into a closed box.

### Instrument

The pre-tested instrument compromised questions of socio-demographics, health-promoting and health-risk behaviours, stress and well-being of participants. This instrument will be used consistently each semester and consists of 35 questions. Recommendations for health behaviours were considered relating to various institutes. For example: healthy nutrition and physical activity (World Cancer Research Fund / American Institute for Cancer Research 2007a); binge-drinking and heavy smoking [Federal Center of Health Information (Bundeszentrale für gesundheitliche Aufklärung 2012)].

*Socio-demographics*

Questions on socio-demographics include sex, age, family status relating to partnership and parenthood, housing, and financial situation with regard to kind of financing and budget per month. Semester and course as well as preference for using right or left hand were also considered.

*Health-promoting behaviours*

In order to calculate vaccination coverage rates, influenza vaccination during the previous 12 months was assessed with a binary item. The average daily-consumed number of servings of fruits and/or vegetables was assessed on an ordinal scale. One serving per day was defined as a hand full of fruits or vegetables. Furthermore, students were asked for average hours per week spent with moderate physical activity; defined as activity which increased sweating. Doing sports together with others was also asked.

*Health-risk behaviours*

To calculate epidemiological measures of alcohol consumption (e.g. life-time prevalence, 30-day prevalence), we asked students if they have never drank alcohol or ever, and whether or not during the previous 30 days. If they reported alcohol intake during the previous 30 days, frequency of consumption was assessed on an ordinal scale. Binge-drinking was defined as at least five drinks of alcohol beverages at one occasion. Definitions for the size of glasses per drink were provided in the questionnaire. Number of binge-drinking episodes during the previous 30 days was considered.

Tobacco and shisha smoking was questioned just like alcohol consumption. If students reported tobacco smoking at more than 20 days during the previous 30 days, number of cigarettes per day was assessed on an ordinal scale. Heavy smoking was defined as at least 20 cigarettes per day. If students ever smoked shisha, they were asked if they regularly smoke shisha alone or in company.

Pharmacological "cognitive enhancement" (CE) was reflected, providing information on the intake of prescription stimulants (e.g. methylphenidate) and/or illicit drugs (e.g. cannabis) used to enhance mental capacity. Independently, use of potentially harmful drugs (antibiotics, painkiller and tranquilizer) was assessed. Next to a pooled category assessing the use of various drugs (e.g. ecstasy, cocaine), cannabis was asked as a separate category. Answer formats ranged from never through once during the last 12 months/30 days to regular use, defined as at least at 10 days during the last 30 days, respectively. If students reported that they have ever consumed one of the substances, we asked whether they receive medical prescription for these.

*Self-rated stress, physical and mental well-being*

Students were asked to individually judge their stress level, physical and mental well-being during the previous 4 weeks on a self-developed 11-point scale ranging from low to high levels.

### Data management and plausibility checks

Data from completed questionnaires were entered twice for verification into an access data base via an Epi Info™ 7 data entry tool (Aponte et al 2014), mirroring the original questionnaire. Plausibility checks compromised comparison of datasets, review of missing values, verification of logical combinations, all carried out with Epi Info™ 3.5.4 (Center of Disease and Control 2008).

### Statistical analyses

The response proportion resulted from attending students, who filled in the questionnaire divided by all who received a questionnaire during courses. According to the study protocol, individuals who did not meet the inclusion criteria were excluded from subsequent analyses (see footnote table 1). The proportion of surveyed students was defined relative to enrolled students for each semester. Data quality was assessed by relative and absolute frequencies of complete and incomplete questionnaires. Socio-demographic characteristics and prevalences of selected health behaviours were presented by absolute and relative frequencies with 95% confidence interval (95% CI). Analyses were stratified for

surveys. IBM SPSS statistics for Windows (version 20) was used for statistical analyses (IBM Corporation 2011).

### Ethical and legal considerations

The surveillance system is in accordance with human laws, the Declaration of Helsinki, guidelines provided by the German Society of Epidemiology and data protection regulation. Standardized oral and written information about the investigation were provided prior to participation to guarantee informed consent. Participation was voluntary and there were no penalties for students if questionnaires were not completed. Data was collected anonymized assuring privacy of participants. The study protocol is currently under evaluation by an independent ethic committee of the Competence Center Health at HAW Hamburg (up to now: oral confirmation).

## RESULTS

### Participation

The recruitment of the pilot survey took place between the 11$^{th}$ and 13$^{th}$ week of the summer semester 2014. During this time, 92 students attending courses filled in the questionnaire (response: 97.9%). Data of the first survey was assessed earlier during the semester (5$^{th}$/6$^{th}$ week). This resulted in a similar response (98.8%) while more students were reached (n=161). Overall, 41.2% of eligible students were recruited in the pilot survey, whereas the proportion for the first survey was 83.0% (Table 1).

### Data quality indicated by missing and implausible values

For both - pilot and first survey - the number of missing values over all items ranged from 0 to 5, whilst more than 80% of participants filled in the questionnaires completely (81.2% vs. 82.8%). Questions about health-risk behaviours showed higher numbers of missing values than all other questions. Besides, 3.5% of participants of the pilot survey gave logical inconsistent responses whereas the relative frequency was lower (0.7%) in the first survey (Table 2). Logical inconsistency was exclusively found for binge-drinking.

### Socio-demographic characteristics [2]

Most of surveyed students of the first survey were women (85.4%). The median age was 24 years (25$^{th}$-75$^{th}$ percentile: 22-26 years). Further socio-demographic characteristics are provided in table 3.

[2] Results presented hereinafter referred to the first survey; if not specified further.

### Prevalence of health-promoting behaviours

Table 4 presents health-promoting behaviours for students with 95% CI. Influenza vaccination coverage rates were low in our sample (7.3%). The minority of students ate at least five servings of fruits and vegetable per day (12.6%), whereas most reported to eat 1 to 2 servings per day (57.6%). Almost all students were physical active, that stimulates respiration (97.3%). 56.0% of surveyed students reported to do at least moderate physical activity for at least 3.5 hours per week.

### Prevalence of health-risk behaviours

76.2% reported to consumption of alcohol within 30 days prior to the survey. Among these, most were classified as infrequent bingers (binge-drinking on 1 to 2 days; 33.9%). In contrast, 6.2% of these students performed binge-drinking on at least 6 days. 16.8% of surveyed students were regular smokers but none were classified as heavy smokers. Despite the fact that more than one third of students ever tried out shisha smoking during their life, 6.4% have smoked shisha during the previous 30 days (Table 5).

Almost half of students used painkillers during the 30 days prior to the survey. However, the prevalence of regular intake during this period was 5.4% (Figure 1). Also, almost just as many surveyed students used cannabis more than 10 times during the previous 30 days (4.0%) (Figure 2). 12.6% of students reported that they used substances to enhance their cognition during the last 12 months. Additionally, 4.6% used regular CE during the previous 30 days, whereas it was less common in the pilot survey (1.2%) (Figure 3).

## DISCUSSION

### Discussion of methods

As part of the established health surveillance system, undergraduate Health Sciences students filled in a *short* and *easily understandable paper-pencil questionnaire* during courses. In contrast to computer-assisted instruments in schools or universities, this “keep it stupid simple” approach offers advantages for researchers as well as for the participants. First, researchers face less logistics and less costs (Brener et al 2006; Denniston et al 2010). Second, paper-pencil questionnaires provide more complete data compared to web-surveys (Brener et al 2006; Denniston et al 2010). Third, they improved actual and perceived privacy and anonymity for participants (Kann et al 2002; Brener et al 2006). Fourth, relatively quick to complete questionnaires do not contribute to boredom or fatigue that could cause students to give inaccurate and/or incomplete responses (Center of Disease and Control 2014). However, there are also disadvantages of our method: Com-

puter-assisted instruments would eliminate the need of transferring data in computer-readable formats; would simplify completion of questionnaires by use of skip-patterns and interactive presentation; and also would allow real time plausibility controls (Dillman 2000). Nevertheless, high response, less incomplete questionnaires and only few inconsistent responses in our surveys indicate high acceptance of students and therefore improved data quality. This confirms our decision with a paper-pencil approach. All previously mentioned aspects are essential for our surveillance systems, which will collect data *periodically* over years. Independently, the shortness of questionnaires restricts in-depth information. Hence, surveillance systems like ours result in superficial information to pose questions instead of testing hypotheses (Buehler 2008).

To increase anonymity of students, we improved standardization in conduction of surveys by several methodological approaches: e.g. standard operating protocols, training of survey administrators, folding up completed questionnaires to cover answers, placing these in closed boxes. Unexpectedly, effort in standardization did not increase response and number of completed questionnaires. Nonetheless, this might have contributed to fewer inconsistent answers. Above all, it guarantees standardized data collection and comparability of data over years, especially if various survey administrators are involved in the ongoing project (German Society for Epidemiology 2008; Center of Disease and Control 2014).

Participation of students is a main prerequisite for the success of such a health surveillance system. For both - pilot and first survey- response was almost 100% among students who attended courses. In relation to the number of students not attending courses, the participation proportion was lower, especially for the pilot survey (41.2%). For this reason, future data collection will be conducted in the beginning of the semesters. This methodological adaption made it possible to reach twice as many students in the first survey. Comparable response proportions were seen in surveys at European universities using similar methods (Stock and Krämer 2001; Steptoe and Wardle 2001; Peltzer and Pengpid 2014). In contrast, web-surveys on the health of students in Germany achieved low responses of 6-12% (Gusy et al 2010b; Lohmann et al 2010; Gusy et al 2010a; Borczyskowski et al 2014). Even if a mixture of several methods (e.g. repeated information via e-mails, lecturers or Facebook) was applied to recruit students, 6.2% of currently enrolled students of all departments at the HAW Hamburg filled in a web-survey about students' substance abuse (INSIST project) within 18 weeks (Borczyskowski et al 2014). The highest response for this survey was achieved among Health Sciences students (18.6%) (Borczyskowski et al 2014). This demonstrates that acceptance, motivation and willingness to participate are higher among Health Sciences students compared to others,

leading to an almost complete convenience sample in our surveys. Possible reasons for this might be that Health Sciences students are more accustomed to surveys due to research orientation of the curriculum and interest in health topics.

Surveys as well as health surveillance system are prone to bias, which might limit our results: *First,* non-response bias could threaten validity of results. However, Stang & Jöckel (2004) assumed that studies which only recruit once and do not apply intensified recruitment of non-responders are assumed to be less biased (Stang and Jöckel 2004). In our surveys, we used one attempt to recruit students. By doing so, we achieved an almost complete sample of eligible students within the first survey. Hence, this limitation is assumed to be less prominent. Nevertheless, selectiveness of our sample relating to students who missed courses due to several reasons (e.g. acute illness) might limit the representativeness of our results. *Second*, selection bias due to interest in topics of the survey is assumed to be low, because almost every student participated. However, students might have felt under pressure to complete questionnaires immediately during courses, even if participation was voluntary. This in turn could endanger honesty to some extent. To make the atmosphere more pleasant and minimize 'sense' of pressure, fellow students instead of researchers carried out the surveys. Additionally, lecturers were asked to leave the room during data collection. *Third,* reporting bias could result in unreliable or dishonest answers especially if self-reported information was collected (Steptoe et al 2002a). In particular, truthful answering of sensitive questions on illegal and socially stigmatized topics tend to be influenced by social desirability (Gordis 2001). This is certainly important to consider, but reporting bias is assumed to be constant over time (Steptoe et al 2002a). *Fourth,* recall bias for intake of substances, mainly if substances are consumed irregularly, might lead to underestimations of prevalences. Moreover, generalizability is limited by its single-centred nature and a focus on Health Sciences students. Also, no follow-up of individuals but rather of cohorts is possible, owing to the fact that anonymized data is collected to improve data protection and privacy of individuals.

Besides existing difficulties, the major strength of our health surveillance system is its longitudinal design. This enables comparison between semesters, follow-up of cohorts during their course of studies and description of trends in health behaviours of Health Sciences students over time. This provides a basis for researchers to figure out the need for action and/or evaluate health promotion and prevention campaigns on the campus as well as federal initiatives. In order to ensure this, methods are applied, which are easy to conduct, need less logistics and less costs. Due to highly standardized procedures, comparability of results over time is guaranteed.

Overall, internationally accepted and uniformly used definitions of health behaviours (e.g. binge-drinking and CE) are lacking. Hence, development of questionnaires and comparison with national or international studies is difficult. However, comparability of our data over time is assured due to internal consistency of the instrument.

### Discussion of results

The results we present suggest that surveyed undergraduate Health Sciences students engage in health-risk behaviours, e.g. binge-drinking, cannabis use, smoking whereas none of them were classified as heavy smokers. Moreover, in this sample unhealthy diet was prevalent but almost all performed physical activity which increased sweating.

More particularly, we found a high prevalence of low fruit and/or vegetable consumption (<5 servings per day). If we compare this with other surveys among students, Health Sciences students eat a healthier diet (Meier et al 2007; Keller et al 2008; American College Health Association 2010). Small differences were seen between subjects, while 94.6% of medical students do not meet the recommendation compared to approximately 97.5% of law or teaching students (Keller et al 2008). Similar results have been reported previously among students in Asia, Africa and the Americas, whereas differences were seen between countries (Peltzer and Pengpid 2014). Several reasons for inadequate fruit and/or vegetable consumption were discussed (e.g. lack of economic resources, living situation, psychosocial factors) (Peltzer and Pengpid 2014). In consideration of health benefits from fruit and vegetable consumption in reducing non-communicable diseases (Lock et al 2005), our results underline the urgent need for further behavioural and conditional health promotion among Health Sciences students, who are generally assumed to be well informed about the necessity of a healthy diet.

The results of this study indicated that binge-drinking is common among Health Sciences students. More than 25% of all alcohol-drinking students of this investigation reported at least three binge-drinking episodes during the last 30 days. In comparison, binge-drinking at three to five days is more common among Health Sciences students in Hamburg (20.5%) than compared to surveyed medical, law or education students in Marburg (9.1%), despite methodological differences (Keller et al 2008). However, binge-drinking overall during the last 30 days was less common among Health Sciences students than among those of different subjects (Keller et al 2008; Gusy et al 2014). In case of binge-drinking, researchers face various definitions that limit comparability of results; as also shown for the UK (Gill 2002) and the USA (Courtney and Polich 2009). For example, our definition of at least five alcoholic drinks at one occasion was analogous to the German Drug affinity study (Bundeszentrale für gesundheitliche Aufklärung 2012), whereas

others differentiate between women (≥4 drinks) and men (≥5 drinks) (Keller et al 2008). This would rather increase our binge-drinking prevalences in female students and overall, because more than 80% of Health Sciences students in our sample were female. Apart from methodological differences, one could argue that alcohol or rather binge-drinking prevalence might be high in our sample, because data was obtained in the beginning of the semester where duties and responsibilities are assumed to be lower. However, compared to the pilot survey, where data was assessed almost at the end of the semester, similar results were seen. Hence, this indicates that binge-drinking behaviours might be independent from the point of semester time. Widespread health promotion campaigns of the Federal Center of Health Education in Germany, e.g. “Alkohol? Kenn dein Limit” (“Alcohol? Know your limit”), aim to decrease risky alcohol consumption and improve knowledge on negative effects of excessive alcohol drinking among young adolescents (Bundeszentrale für gesundheitliche Aufklärung 2015). Under consideration of such national investigations, the need of monitoring trends in students’ alcohol consumption patterns increases.

CE has been subject to little research worldwide. Hence our results provide new insights. Every eighth student of our survey reported intake of prescription stimulants and/or illicit drugs to enhance cognitive performance during the last year. More strikingly, 7% did so during the last 30 days. In reference to national and international investigations on CE, varying results were reported. For example, in Germany 1–13% of the surveyed students at different universities took prescription stimulants or illicit drugs at least once in their lifetime (Mache et al 2012). Dietz et al (2013) used an anonymous specialized questionnaire technique and reported a 12-months prevalence of 20% with variation between subjects (e.g. 25.4% in sport related fields and 12.1% for languages and education) (Dietz et al 2013). Looking abroad, non-medical prescription stimulant use during the past month were similar, while prevalences at colleges ranged from zero to 13% (McCabe et al 2005). However, several methodological differences make the comparison difficult. This relates to comparison of participants, mode of questionnaire and in turn degree of anonymity, epidemiological measures, and - above all - definition of CE (Franke et al 2014). By including cannabis in the definition of CE and asking for use of cannabis independently might have led to comparable prevalences for both. Hence, CE prevalences could be driven by cannabis use, whereas 12-months prevalences differ remarkably. Nevertheless, results indicate that the use of CE among students needs further attention among policy makers, on the one hand addressing overwhelming demands, which might lead students to use CE and on the other hand, to inform students about potential health risk related to CE.

In conclusion and to our best knowledge, this health surveillance system for Health Sciences students is unique in Germany. Since 2014, we established standardized data collection procedures, which speed up implementation. From now on, Health Sciences students will be monitored twice a year. Furthermore, we report comprehensive data on students' health, which expands knowledge on students' health needs in Germany. Within a few years, detailed descriptions of trends in health behaviours of students will be published, and hence, will provide valuable information to an area of research that still needs to be investigated. Until then, first results indicate areas where health professionals and policy makers should tackle health behaviour deficits of students. Next, research needs to be put into practice and promote not only the health of general students but also of Health Sciences students, who might become the next professional health promoters.

## ACKNOWLEDGEMENT

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## CONFLICT OF INTEREST

None.

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## TABLES

**Table II - 1.** Response and participation in the health surveillance system of undergraduate Health Sciences students according to the survey, Germany 2014 (*n*=253)

| | **Pilot survey** (n = 92) | **First survey** (n = 161) |
|---|---|---|
| | % | % |
| **Response proportion** | 97.9 | 98.8 |
| Minimum response proportion | 92.3 | 97.5 |
| Maximum response proportion | 100 | 100 |
| **Proportion of surveyed students relative to enrolled undergraduate Health Sciences students** | 41.2 [a] | 83.0 [b] |
| Minimum proportion relative to enrolled students | 29.5 [a] | 62.7 [b] |
| Maximum proportion relative to enrolled students | 67.4 [a] | 100 [b] |

[a] 7 individuals did not meet the inclusion criteria and were therefore excluded [missing values relating to semester (n=4) or ≤ 5$^{th}$ semester (n=3)].

[b] 10 individuals did not meet the inclusion criteria and were therefore excluded [≤ 5$^{th}$ semester (n=8), no undergraduate Health Sciences students (n=1), course of studies was unknown (n=1)].

**Table II - 2.** Degree of complete or incomplete questionnaires according to the survey among undergraduate Health Sciences students at HAW Hamburg, Germany 2014 (*n*=236)

| | **Pilot survey** (n = 85) | | **First survey** (n = 151) | |
|---|---|---|---|---|
| | n | % | n | % |
| **Completeness** | | | | |
| Completed questionnaires | 69 | 81.2 | 125 | 82.8 |
| At most 1 missing value [a] | 8 | 9.4 | 12 | 7.9 |
| At least 2 missing values [a] | 8 | 9.4 | 14 | 9.3 |
| **Inconsistency** | | | | |
| Inconsistent responses [b] | 3 | 3.5 | 1 | 0.7 |

[a] Missing values resulting from students' failure to answer a question

[b] Inconsistent responses resulted from logical inconsistency with responses of other answers and were set to missing during data plausibility checks.

**Table II - 3** Socio-demographic characteristics of undergraduate Health Sciences students across surveys, Germany 2014 (*n*=236)

| | **Pilot survey** (n = 85) | | | **First survey** (n = 151) | | |
|---|---|---|---|---|---|---|
| | n | % | 95% CI | n | % | 95% CI |
| **Sex** | | | | | | |
| Women | 67 | 78.8 | 70.0-87.7 | 129 | 85.4 | 79.7-91.1 |
| Men | 18 | 21.2 | 12.3-30.0 | 22 | 14.6 | 8.9-20.3 |
| **Age in years** | | | | | | |
| 18-21 | 23 | 27.1 | 17.4-36.7 | 37 | 24.7 | 17.7-31.6 |
| 22-25 | 38 | 44.7 | 33.9-55.5 | 66 | 44.0 | 36.0-52.0 |
| 26-29 | 16 | 18.8 | 10.3-27.3 | 37 | 24.7 | 17.7-31.6 |
| ≥ 30 | 8 | 9.4 | 3.1-15.8 | 10 | 6.7 | 2.6-10.1 |
| **Relationship** | | | | | | |
| Single | 3 | 36.9 | 26.4-47.4 | 58 | 38.4 | 30.6-46.3 |
| Partnership | 50 | 59.5 | 48.8-70.2 | 86 | 57.0 | 49.0-65.0 |
| Married | 3 | 3.6 | 0-7.6 | 7 | 4.6 | 1.2-8.0 |
| **Housing** | | | | | | |
| Individual apartment | 11 | 13.1 | 5.7-20.5 | 24 | 15.9 | 10.0-21.8 |
| Shared apartment | 18 | 21.4 | 12.5-30.4 | 38 | 25.2 | 18.2-32.2 |
| Dormitory | 5 | 6.0 | 0.8-11.1 | 13 | 8.6 | 4.1-13.1 |
| Shared apartment with partner | 22 | 26.2 | 16.6-35.8 | 36 | 23.8 | 17.0-30.7 |
| Parental home | 28 | 33.3 | 23.0-43.6 | 40 | 26.5 | 19.4-33.1 |

**Table II - 4.** Prevalence of health-promoting behaviours across surveys among undergraduate Health Sciences students at HAW Hamburg, Germany 2014 (*n*=236)

| | **Pilot survey** (n = 85) | | | **First survey** (n = 151) | | |
|---|---|---|---|---|---|---|
| | n | % | 95% CI | n | % | 95% CI |
| **Influenza vaccination** | | | | | | |
| Yes | 6 | 7.1 | 1.5-12.6 | 11 | 7.3 | 3.1-11.5 |
| No | 79 | 92.9 | 87.4-98.5 | 140 | 92.7 | 88.5-96.9 |
| **Fruit and vegetable intake** | | | | | | |
| None | 5 | 5.9 | 0.8-11.0 | 2 | 1.3 | 0-3.2 |
| 1-2 servings per day | 13 | 36.5 | 26.0-46.9 | 87 | 57.6 | 49.6-65.6 |
| 3-4 servings per day | 37 | 43.5 | 32.8-54.3 | 43 | 28.6 | 21.2-35.8 |
| ≥ 5 servings per day [a] | 12 | 14.1 | 6.6-21.7 | 19 | 12.6 | 7.2-17.9 |
| **Physical activity** | | | | | | |
| No moderate physical activity | 4 | 4.7 | 0.1-9.3 | 4 | 2.7 | 0.1-5.3 |
| < 3.5 h moderate physical activity / week [b] | 33 | 38.8 | 28.3-49.4 | 62 | 41.3 | 33.4-49.3 |
| ≥3.5 h moderate physical activity / week [b] | 48 | 56.5 | 45.7-67.2 | 84 | 56.0 | 48.0-64.0 |

[a] Categorization of fruit and vegetable intake were inspired by the World Cancer Research Fund and corresponds to at least five servings of a variety of fruits and/or vegetables per day (World Cancer Research Fund / American Institute for Cancer Research 2007b).

[b] Categorization of physical activity, which stimulates respiration, was inspired by the World Cancer Research Fund and corresponds to moderate physical activity for at least 30 minutes per day (World Cancer Research Fund / American Institute for Cancer Research 2007c).

**Table II - 5.** Prevalence of health-risk behaviours across surveys among undergraduate Health Sciences students at HAW Hamburg, Germany 2014 (*n*=236)

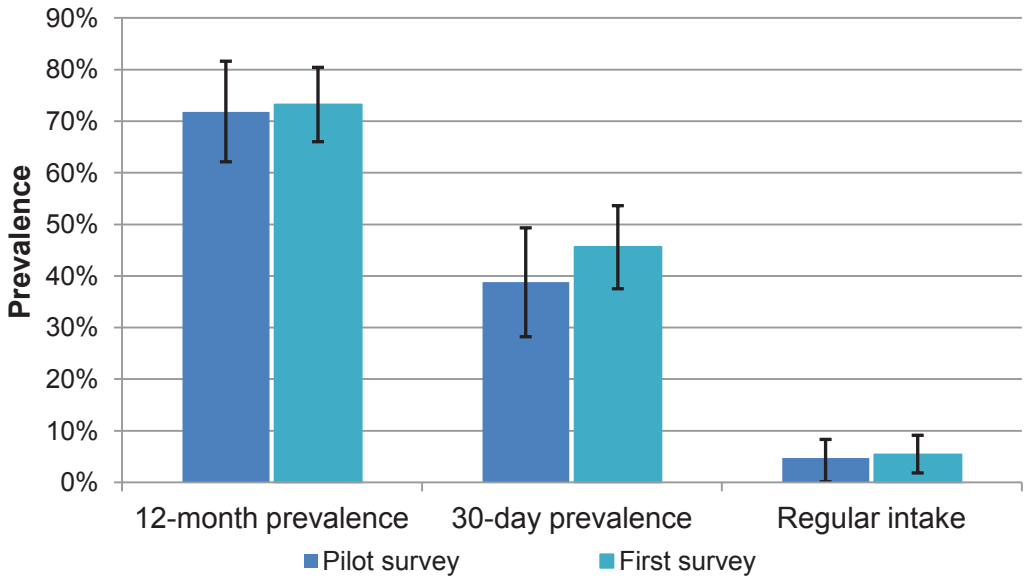
| | **Pilot survey** (n = 85) | | | **First survey** (n = 151) | | |
|---|---|---|---|---|---|---|
| | n | % | 95% CI | n | % | 95% CI |
| **Alcohol consumption** | | | | | | |
| 30-day prevalence | 55 | 64.7 | 54.4-75.1 | 115 | 76.2 | 69.3-83.0 |
| *Binge-drinking during the last 30 days* | | | | | | |
| Non-bingers [a] | 15 | 28.3 | 15.7-40.8 | 38 | 33.9 | 25.0-42.8 |
| Infrequent bingers [b] | 24 | 45.3 | 31.4-59.1 | 44 | 39.3 | 30.1-48.5 |
| Bingers [c] | 12 | 22.6 | 11.0-34.3 | 23 | 20.5 | 12.9-28.1 |
| Frequent bingers [d] | 2 | 3.8 | 0-9.1 | 7 | 6.2 | 1.7-10.8 |
| **Cigarette smoking** | | | | | | |
| 30-day prevalence | 15 | 18.5 | 9.9-27.2 | 42 | 28.2 | 20.9-35.5 |
| Regular smoking [b] | 7 | 8.6 | 2.4-14.9 | 25 | 16.8 | 10.7-22.9 |
| *Intensity of regular smoking* | | | | | | |
| <10 cigarettes per day | 4 | 66.7 | 12.5-100 | 15 | 68.2 | 47.0-89.3 |
| 10-19 cigarettes per day | 2 | 33.3 | 0-87.5 | 7 | 31.8 | 10.7-53.0 |
| ≥ 20 cigarettes per day | 0 | 0 | 0 | 0 | 0 | 0 |
| **Shisha smoking** | | | | | | |
| 30-day prevalence | 4 | 4.9 | 0.8-10.7 | 9 | 6.4 | 2.2-10.0 |
| Regular smoking [e] | 0 | 0 | 0 | 0 | 0 | 0 |

Binge-drinking in the previous 30 days was defined according to Keller et al (2008):
[a] *Non-bingers* (alcohol consumption during the previous 30 days but no binge-drinking episode);
[b] *infrequent bingers* (1-2 binge-drinking episodes during the previous 30 days),
[c] *bingers* (3-5 binge-drinking episodes during the previous 30 days);
[d] *frequent bingers* (at least 6 binge-drinking episodes during the previous 30 days) (Keller et al 2008).

[e] Regular smoking was defined as smoking on at least 21 days during the previous 30 days.

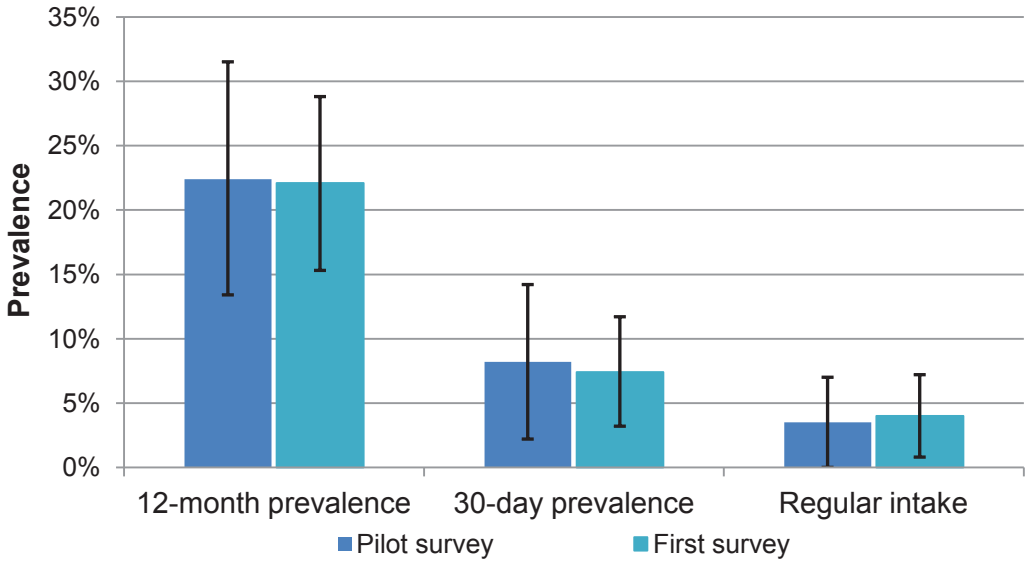
## FIGURES

**Figure II – 1** Prevalence of *painkiller* use across surveys among undergraduate Health Sciences students at HAW Hamburg, Germany 2014 (*n*=236).



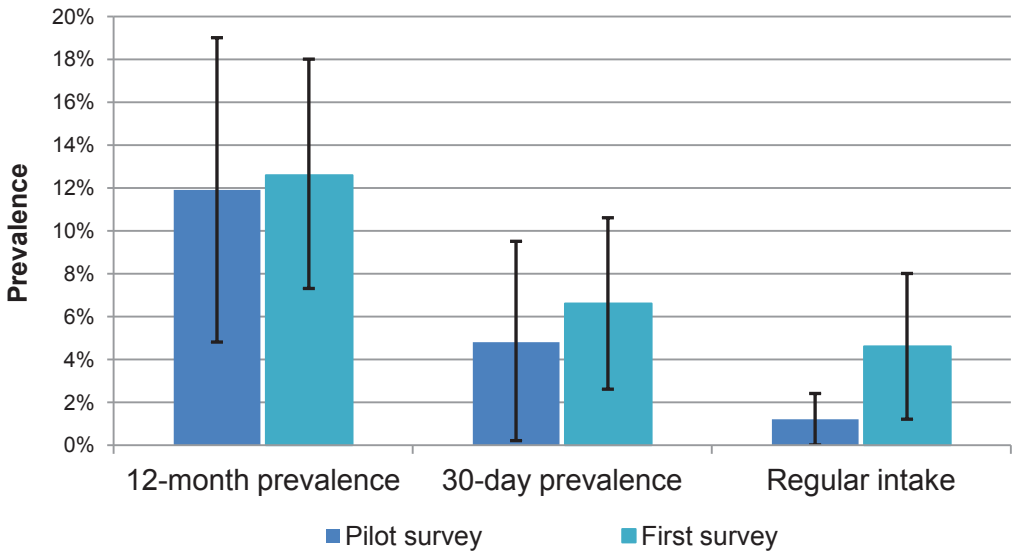

Error bars indicate 95% CIs. Regular intake was defined as intake of substances on at least 10 days during the previous 30 days.

**Figure II – 2** Prevalence of *cannabis* use across surveys among undergraduate Health Sciences students at HAW Hamburg, Germany 2014 (*n*=236).




Error bars indicate 95% CIs. Regular intake was defined as intake of substances on at least 10 days during the previous 30 days.

**Figure II – 3** Prevalence of *pharmacological* "*cognitive enhancement"* use across surveys among undergraduate Health Sciences students at HAW Hamburg, Germany 2014 (*n*=236).




Error bars indicate 95% CIs. Regular intake was defined as intake of substances on at least 10 days during the previous 30 days.

## 8. STATUTORY DECLARATION

I herby confirm that I am the author of the thesis presented. I have written the thesis as applied for previously unassisted by others, using only the sources and references stated in the text.

Reinbek, 27th January 2015

……

(Sandra Tobisch)

# 9. APPENDIX

## 9.1 Paper-pencil questionnaire of the health behaviour surveillance system at HAW Hamburg

On the following pages you find the original paper-pencil questionnaire of the health behaviour surveillance system at University of Applied Sciences. This one was used in the first standardized survey.

Hochschule für Angewandte Wissenschaften Hamburg
*Hamburg University of Applied Sciences*

# SURVEILLANCE-SYSTEM

## zur Beobachtung des Gesundheitsverhaltens von Studierenden

### Hochschule für Angewandte Wissenschaften Hamburg (HAW) im Department Gesundheitswissenschaften

**Liebe Teilnehmerin, lieber Teilnehmer des hochschulinternen Surveillance-Systems,**

*Vor Abgabe bitte hier knicken.*

wir freuen uns, dass Sie sich ein wenig Zeit nehmen, um den folgenden Fragebogen auszufüllen.

Sie leisten hiermit einen wichtigen Beitrag, das Gesundheitsverhalten der Studierenden an der HAW Hamburg zu erfassen. Hintergrund dieser Befragung ist, dass es bislang wenige Daten zum Gesundheitszustand von Studierenden gibt; deutschlandweit wie auch an der HAW.
Diese Wissenslücke möchten wir füllen. Daher ist es das Ziel, den Gesundheitszustand der Studierenden in regelmäßigen Abständen zu erheben, um Vergleiche anzustellen und Trends entdecken zu können.

Der Fragebogen wird ca. 5 Minuten Zeit in Anspruch nehmen. Wir möchten Sie bitten, den Fragebogen möglichst vollständig auszufüllen. Nur so können wir Aufschluss über den Gesundheitszustand der Studierenden an der HAW Hamburg erlangen.

Sie bleiben bei Ihrer Teilnahme vollkommen anonym, da keine personenidentifizierenden Daten erhoben werden. Es erfolgt ausschließlich die Auswertung der Gesamtergebnisse; Einzelergebnisse werden nicht betrachtet. Daher ist es nicht möglich, Rückschlüsse auf Ihre Person zu ziehen.

Mit dem Beantworten der Fragen erklären Sie sich bereit, dass wir Ihre Daten zur anonymen Auswertung verwenden dürfen.

**Bevor Sie den Fragebogen in die Urne werfen, knicken Sie diesen bitte an der gestrichelten Linie mit dem Deckblatt nach außen.**

Vielen Dank für Ihre Unterstützung!

*Das Projektteam Gesundheitsberichterstattung*

## Allgemeine Informationen

**1. Geschlecht** ☐ Männlich ☐ Weiblich

**2. Alter** _____ Jahre

**3. Beziehungsstatus** ☐ Single ☐ Partnerschaft ☐ Verheiratet

**4. Haben Sie Kinder?**

☐ Nein

☐ Ja → **Leben diese mit Ihnen in einem Haushalt?** ☐ Ja ☐ Nein

**5. Wie finanzieren Sie sich?** *(Mehrfachnennung erlaubt!)*

| Familie | BAföG | Stipendium | Bildungskredit | Erwerbstätigkeit | Sonstiges |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**6. Wie viel Geld steht Ihnen monatlich insgesamt zur Verfügung?**

| 200 – 400 € | 401 – 600 € | 601– 800 € | 801 – 1000 € | > 1000 € |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

**7. Wie ist Ihre derzeitige Wohnsituation?**

| Allein | WG | Mit Partner/in | Bei den Eltern | Studentenwohnheim |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

**8. Welche Hand/Hände benutzen Sie vorwiegend im Alltag?**

| Die rechte Hand (Rechtshänder/in) | Die linke Hand (Linkshänder/in) | Beide Hände |
|---|---|---|
| ☐ | ☐ | ☐ |

**9. In welchem Fachsemester studieren Sie derzeit?** _____ Fachsemester

**10. Studieren Sie derzeit Gesundheitswissenschaften?** ☐ Ja ☐ Nein

## Gesundheitsbezogene Informationen

**11. Haben Sie sich in den letzten 12 Monaten gegen Influenza (Grippe) impfen lassen?**

☐ Ja ☐ Nein

**12. Wie viele Portionen Obst und Gemüse essen Sie durchschnittlich an einem Tag?**
*[Eine Portion entspricht einer Hand voll Obst oder Gemüse.]*

| 0 Portionen | 1-2 Portionen | 3-4 Portionen | 5-6 Portionen | >6 Portionen |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

## Gesundheitsbezogene Informationen

**13. Wie viele Stunden in der Woche sind Sie im Durchschnitt körperlich aktiv?**
*[D.h. Sie kommen mind. leicht ins Schwitzen und Ihr Puls erhöht sich merklich.]*

_____ Stunde(n) pro Woche

**14. Betreiben Sie Sport in einer Gemeinschaft?**

☐ Ja ☐ Nein

**15. Bewerten Sie Ihr Stressniveau der letzten 4 Wochen auf einer Skala von 0-10.**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Niedriges Stressniveau | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Hohes Stressniveau |

**16. Bewerten Sie Ihr Wohlbefinden der letzten 4 Wochen auf einer Skala von 0-10.**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Niedriges **körperliches** Wohlbefinden | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Hohes **körperliches** Wohlbefinden |
| Niedriges **psychisches** Wohlbefinden | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Hohes **psychisches** Wohlbefinden |

## Alkohol

**17. Wie oft haben Sie Alkohol getrunken?**
*[Ein alkoholisches Getränk entspricht: 0,33l Bier; 0,25l Wein oder Sekt; 0,02l (2cl) Spirituosen (z.B. Longdrink); ein Cocktail entspricht 2 Getränken (4cl)]*

| | | In den letzten 30 Tagen | | | |
|---|---|---|---|---|---|
| Noch nie | Jemals, aber **nicht** in den letzten 30 Tagen | An 1-4 Tagen | An 5-10 Tagen | An 11-20 Tagen | An 21 Tagen bis täglich |
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**18. An wie vielen Tagen haben Sie in den letzten 30 Tagen mehr als 5 alkoholische Getränke hintereinander getrunken?**
*[Siehe Definition der vorherigen Frage.]*

_____ Tag(e)

## Leistungssteigerung

**19. Wie häufig haben Sie zur Leistungssteigerung Medikamente oder Substanzen wie zum Beispiel Ritalin®, Antidepressiva, Betablocker, Vigil, Ecstasy, Amphetamine, Cannabis oder andere genommen?**

| Nie | Jemals, aber **nicht** innerhalb des **letzten Jahres** | Mindestens **1x** innerhalb des **letzten Jahres** | Mindestens **1x** innerhalb der **letzten 30 Tage** | **Regelmäßig** (an mind. 10 Tagen im Monat) |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

## Zigaretten und Shisha

**20. Wie oft rauchen Sie Zigarette und/oder Shisha (Wasserpfeife)?**

| | | | In den letzten 30 Tagen | | | | |
|---|---|---|---|---|---|---|---|
| | Nie | Jemals, aber **nicht** in den letzten 30 Tagen | An 1-4 Tagen | An 5-10 Tagen | An 11-20 Tagen | An 21 Tagen bis täglich | |
| **Zigaretten** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ <10 Zigaretten/Tag |
| **Shisha** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ 11-19 Zigaretten/Tag |
| | Weiter mit Frage 22 | | | | | | ☐ ≥20 Zigaretten/Tag |

**21. In welchem Umfeld rauchen Sie Shisha?**

☐ In Gesellschaft ☐ Alleine

## Substanzkonsum

**22. Wie häufig haben Sie die folgenden Substanzen konsumiert und waren diese ärztlich verordnet?**

**Bitte kreuzen Sie die Felder in der Tabelle so an, dass diese Ihren Konsum der angegebenen Substanzen widerspiegeln.**

| | Nie | Jemals, aber **nicht** innerhalb des **letzten Jahres** | Mindestens **1x** innerhalb des **letzten Jahres** | Mindestens **1x** innerhalb der **letzten 30 Tagen** | **Regelmäßig** (an mind. **10 Tagen** im Monat) | Falls ärztlich verordnet, bitte **zusätzlich** ankreuzen! |
|---|---|---|---|---|---|---|
| **Antibiotika** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Schmerzmittel** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Schlaf- und Beruhigungsmittel** (z.B. Baldrian, Diazepam) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Cannabis** (z.B. Gras, Haschisch, Marihuana) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Andere** (z.B. Amphetamine, Speed, Crystal, Ecstasy, Kokain, Opiate) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

# Vielen Dank für Ihre Teilnahme!